DSO068 Digital Oscilloscope

User Manual Rev. 02

Attention

1. Battery voltage must be within 2 - 5V range.
2. Maximum input voltage is 50Vpk for 1X probe.
3. Do not attempt to measure live power directly.

Panel & Connectors

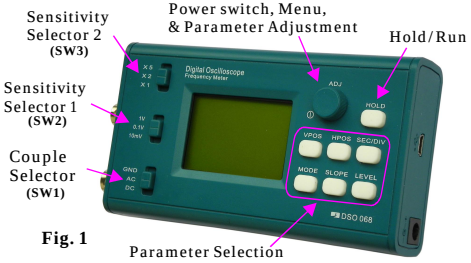


Fig. 1

Fig. 2

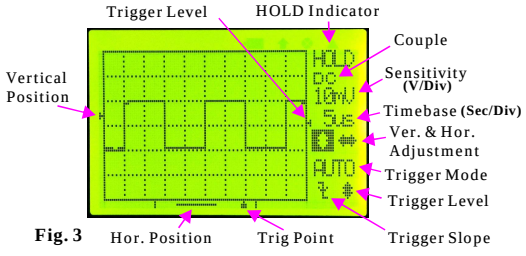


Fig. 3

Fig. 4

Button Functions

Botton functions are mode dependent. Please see their function under different modes below.

Under any mode:
[ADJ] hold - power off, [LEVEL] hold - backlight ON/OFF

1. Oscilloscope Mode

RUNNING	
Button Name	Function
[VPOS]	Select vertical position
[HPOS]	Select horizontal position
[SEC/DIV]	Select timebase
[MODE]	Select trigger mode
[SLOPE]	Select trigger slope
[LEVEL]	Select trigger level
[HOLD]	Enter HOLD
[ADJ] ratating	Adjust parameter selected
[ADJ] press	Enter MENU
[VPOS] hold	Align vertical position
Sen. selector 1	Change sensitivity
Sen. selector 2	Change sensitivity
Couple selector	Change couple

HOLD	
Button Name	Function
[VPOS]	Select vertical position
[HPOS]	Select horizontal position
[MODE]	Select trigger mode
[ADJ] ratating	Adjust parameter selected
[ADJ] press	Enter MENU
[HOLD]	Return to running

MENU	
Button Name	Function
[ADJ] ratating	Select menu item
[ADJ] press	Execute the item selected

2. Frequency Meter Mode

Button Name	Function
[ADJ] press	Enter MENU
Sen. selector 1	Change sensitivity
Sen. selector 2	Change sensitivity
Couple selector	Change couple

3. FFT Mode

Button Name	Function
[ADJ] press	Enter MENU
[HPOS]	Select FFT size
[SEC/DIV]	Select FFT sampling rate
[ADJ] ratating	Adjust parameter selected

Basic Operations

1. Connection Connect probe to the BNC connector marked "INPUT" (Fig 4). Connect USB cable if the unit is powered by USB (Fig. 2).

2. Power on & off Power ON: Press [ADJ] dial once. System will first enter Bootloader, stay for about 2 seconds, and then enter running state.
Power OFF: Hold [ADJ] dial for about 3 seconds.

3. Set parameters Oscilloscope parameters can be grouped by three main catagories: vertical, horizontal, and trigger.

1) Vertical --- including SENSITIVITY, POSITION, and COUPLE.
To set SENSITIVITY use the upper two slide switches. Setting is displayed on screen as "volt/div".
To change vertical POSITION press [VPOS] button and then turn [ADJ] dial.
To change COUPLE use the lower slide switch

2) Horizontal --- including TIMEBASE and POSITION
To set TIMEBASE press [Sec/Div] button and then turn [ADJ] dial.
To change horizontal POSITION press [HPOS] and then turn [ADJ]. Setting is diaplayed as "Second/div" on screen.

3) Trigger --- including trigger MODE, SLOPE, and LEVEL
To set trigger MODE press [MODE] button and then turn [ADJ] dial
To set trigger SLOPE press [SLOPE] button and then turn [ADJ] dial
To change trigger LEVEl press [LEVEL] button and then turn [ADJ] dial

What Trigger Mode Means and How to Use It

The trigger can work under automatic (AUTO). normal (NORM), or single (SING) mode. Under AUTO mode the scope will perform capture and display results no matter there is trigging or not. Under NORM mode the scope performs capture and updates display only when trigging happens. The SING mode is similar to NORM mode. The only difference is under SING mode the scope will enter HOLD state automatically after a capture and will stay untill manual release.

When trigger mode is set to NORM or SING you may find no screen updates. This is because there is no trig happening. In this case you may like first switch to AUTO mode to make sure signal and trigger level are in proper range and then switch back to NORM or SING.

Menu Operations

1. Press [ADJ] to have menu displayed.
2. Turn [ADJ] to select function and press [ADJ] to execute.

Menu Functions

No.	Menu Item	Function Descriptions
0	OSCILLOSCOPE	Enter oscilloscope mode
1	FREQ METER	Enter frequency meter mode
2	FFT	Enter FFT mode
3	SAVE WAVEFORM	Save waveform. The last waveform captured before enter menu is saved to EEPRON. (This function is only available under oscilloscope mode)
4	RECALL WAVEFORM	Recall saved waveform from EEPROM and display it in HOLD state. (This function is only available under oscilloscope mode)
5	SEND SCREEN	Send screen as bitmap file via serial port. The screen right before entering menu will be sent. XModem protocol is used for the transfer. Refer to documents at www.jyetech.com.
6	SEND WAVE DATA	Send waveform data as CSV file via serial port. The displayed waveform right before entering menu will be sent. XModem protocol is used for the transfer.
7	CHANGE REC. LEN	Select record length by turning [ADJ]. Record length can be set to 256, 512, or 1024.
8	CHANGE TRIG POS	Select trigger position by turning [ADJ]. Trigger position can be set to 1% - 100% of capture buffer.
9	TEST SIGNAL	Set the frequency and amplitude of test signal. Use [ADJ] to change frequency. Press [LEVEL] to select amplitude.
10	RESTORE DEFAULT	Reset parameters to factory defaults. See the table in next page for affacted parameters.
11	REBOOT	Reboot device (usually to enter bootloader for firmware upgrading).
12	EXIT	Exit menu and return to previous state.

Advanced Operations

10X Probe Calibration

Due to input capacitance 10X probe must be calibrated for correct amplitude dispaly. The calibration can be perform by use of the built-in test signal generator of 068.

1) Enter menu. Set test signal to 1KHz and 5V respectively.
2) Set the switch on probe handle to "10X" position.
3) Set timebase to 0.2ms and sensitivity to 0.2V (see Fig. 6).
4) Place probe tip onto the central conductor of test signal connector (Fig. 5). Adjust trigger level if display is not stable.
5) Adjust the cap trimmer at probe connector with small screw driver (see Fig. 5) so as sharp rectangle waveform is displayed (middle screen of Fig. 6).

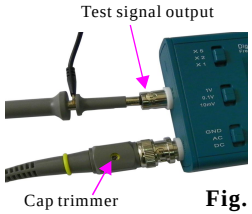
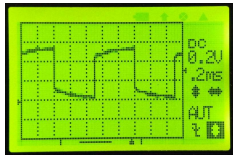
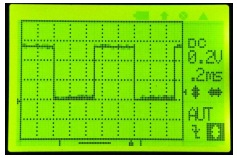


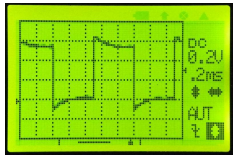
Fig. 5



Not enough



Good



Too much

Fig. 6

Vertical Position Alignment

In case of that there is a mismatch between 0V trace and the vertical position indicator please follow the steps below to eliminate it.

1) Set couple switch to GND position.
2) Hold [VPOS] for about 3 seconds. You should see the 0V trace aligned to the indicator.

USB Connection

In order to use USB function the host which DSO 068 is to communicate with is required to install driver supporting the USB-Uart bridge CP2102. Please use the following link to download driver and install it (refering to documents accompanying).

www.silabs.com/products/mcu/pages/usbtouartbridgevcpdrivers.aspx

Serial Port Parameters

For the main firmware serial port parameters are fixed to 115200 bps and 8-N-1.

For the bootloader serial port parameters are fixed to 9600 bps and 8-N-1.

Screen Image & Waveform Data Upload

Use XModem supporting software(such as Tera Term) for uploading. Name screen image to "bmp" file. Name waveform data to "csv" file. First start sending from menu and then start receiving at host. Note that the screen or waveform displayed right before entering menu will be sent.

Boot Process and Indication

At powering-up or reset system first enters bootloader (bootloader is installed before shipment). LED D1 will flash once. If jumper JP7 is closed buzzer will beep once accordingly. System will stay in bootloader for about 2 seconds detecting firmware upgrading request from host. If no request received it will enter the main firmware.

Once in the main firmware JYE Tech logo will be displayed together with firmware versions. LED D1 will flash twice. If jumper JP7 is closed buzzer will beep twice accordingly. System then enters working state.

The activities of LED and buzzer serve as indication of correct booting.

Forced Default Recovery

Normally factory default can be recovered by menu. It can also be done by connecting PF6 (at J7) to ground and performing reset (press SW12 for example). Remember to disconnect PF6 from ground after recovery is done.

Factory Default

Timebase	1ms/DIV
Vertical Pos	0
Horizon. Pos	80
Trigger Mode	AUTO
Trigger Slope	Falling
Trigger Pos	50%
Record Len.	256 points
Test Sig. Freq.	1000Hz
Test Sig. Amp.	5V

Firmware Upgrading

DSO 068 contains two AVR microcontrollers from Atmel: ATMega64 (U4) and ATMega48 (U5). Their function and performance can be changed by changing firmware.

Note that the firmware of U4 can be changed by programmer or bootloader. Firmware of U5 can only be changed by programmer.

By Programmer

The program ports for U4 and U5 are J4 and J5 respectively. Their pinout is compatible to STK200 and is shown in Fig. 7. It is important to pick up a programmer with matching programming header. JYE Tech offers compatible programmer (PN: 07302).

Follow instructions of selected programmer and host application to perform firmware upgrading.

J4 and J5 pinout

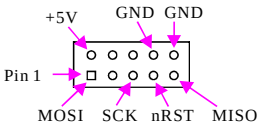


Fig. 7

By Bootloader

DSO 068 has bootloader pre-installed which can work with an PC application via serial connection to perform firmware upgrading. The PC application is called AVRUBD. It can be downloaded at http://www.jyetech.com/Support/avrubd.rar

For how to use bootloader please refer to the aritcle "How to Upgrade Firmware by Bootloader" (http://www.jyetech.com/Support/HowToUpgradefirmwareByBootloader.pdf).

DSO 068 can enter bootloader by one of three methods: 1) powering-up; 2) executing menu item REBOOT; 3) pressing switch SW12.

U4(ATmega64) Fuse Bits

Ext. byte	0xFF
High byte	0xC2
Low byte	0x2E

Fuse Bits Setting

It is important to have correct fuse bit setting for DSO 068 to run normally. The factory fuse setting for U4 and U5 are listed in tables at right. Please do not change them unless you know what you are doing.

U5(ATmega48) Fuse Bits

Ext. byte	0xFF
High byte	0xD6
Low byte	0xE2 ("F" PCB)
	0xE0 ("H" PCB)

Use Battery

DSO 068 can be powered by battery. Typically 3.7V/1200mAh Li-ion battery is used. When fully charged it can run the device about 4 hours with backlight on.

The assembly BOB2 (JYE118) is battery/USB power switch and battery charger. It charges battery once USB is connected. The charging process is fully automatical and terminates itself when battery is full. The charge current can be programmed by R32. Please refer to datasheet of JYE118 for details.

Short JP5 if external battery is to be used. **Note:** Internal battery must be removed in this case.

Equivalent-Time Sampleing (ETS)

When timebase is set to 2us or faster capture will automatically use Equivalent-Time Sampling method. This method can display more details of signal. But there are two conditions for it to work:

1) Signal must be periodic.
2) Trig must happens.

As a result in ETS you may see no screen activity if any of these conditions are not met. In this case try adjusting trigger level to make trig happen.

Note that trig point has no meaning in ETS.

Data Interface

The data interface of DSO 068 is a serial interface of Uart (TTL level) or USB. It has two main functions:

1) Working with jyeLab as USB Scope.
2) High resolution (10 bits) Data Logger.

Details of the data interface are separately documented.

Specifications

Max ETS sampling rate	20MSa/s
Max realtime sample rate	2MSa/s
Analog bandwidth	0 -- 3MHz
Sensitivity range	10mV/div - 5V/div
Max input voltage	50Vpk (1X probe), 400Vpk(10X probe)
Input impedance	1M ohm/20pF
Resolution	8 bits
Record length	256,512,1024 points (variable)
Timebase range	10m(minute)/Div -- 0.5us/Div
Trigger modes	Auto, Normal, and Single
Trigger position range	0% -- 100%
Frequency meter range	5MHz
F. meter sensitivity	0.2Vpp @ 5MHz
Power supply	3.7V Li-ion batter / USB
Current consumption	~300mA (with LCD backlight ON)
Dimension	140 x 70 x 30mm
Weight	~0.18KG (without battery and probe)

DSO 068 Oscilloscope DIY Kit

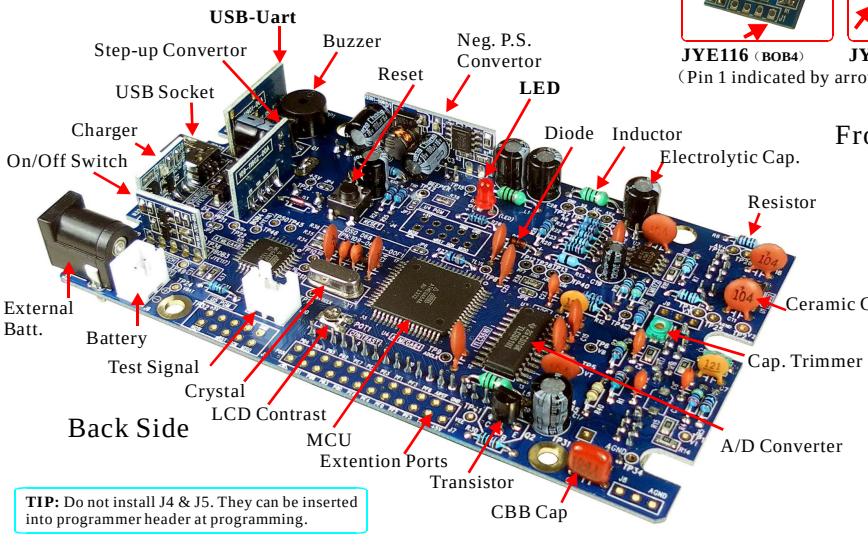
Assembly Guide Rev F01

Step 1 Assembly Main Board

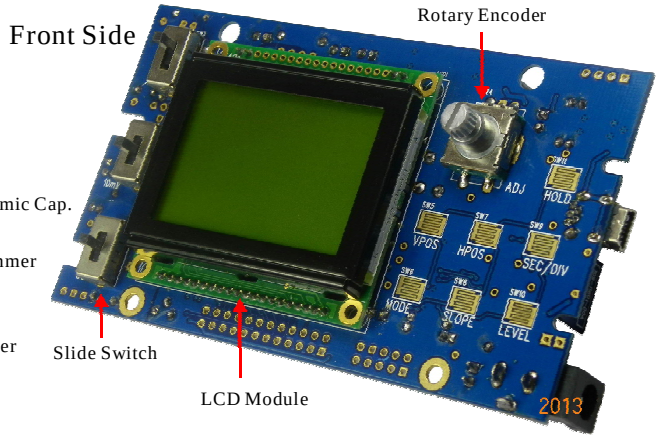
1. Complete the steps in "Get Ready" and understand soldering requirements.
2. Install parts by the order of part list. Start from the back side of main board.
3. Pay special attention to part polarity at soldering. Refer to photos to the right.
4. For BOB boards and LCD soldering refer to photos at bottom for details.
5. After all back side parts are finished perform powering-up test as explained at the reverse page. Continue rest installation if test result is good.

TIP: Resistor values are easily mis-read. Ohm meter check is strongly suggested.

TIP: C3 and R32 are not required.



TIP: Do not install J4 & J5. They can be inserted into programmer header at programming.



Tools

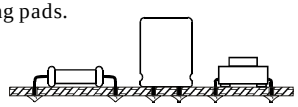
① Iron (20W) ④ Screw driver
② Solder wire ⑤ Flush cutter
③ Multimeter ⑥ Tweezers

Get Ready

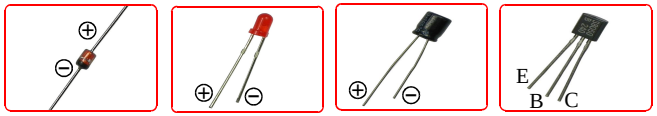
① Check part values & quantities against part list
② Meter and identify resistor values by ohm meter
③ Understand all part polarities and orientations

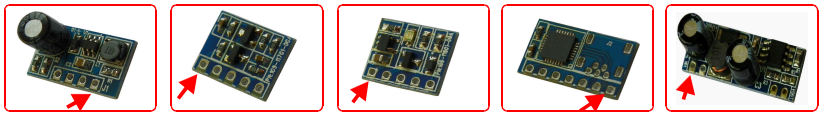
Soldering Skills and Requirements

① Put leads through mounting from installation side of PCB. Ensue they evenly touch PCB (picture below).
② Solder at the other side of PCB. Solder should fully fill and cover soldering pads. Avoid bridges with neighbering pads.
③ Cut unused leads flush with cutter.



Identify Polarity & Orientation





JYE116 (BOB4) **JYE117** (BOB3) **JYE118** (BOB2) **JYE119** (BOB1) **JYE120** (BOB5)

(Pin 1 indicated by arrow)

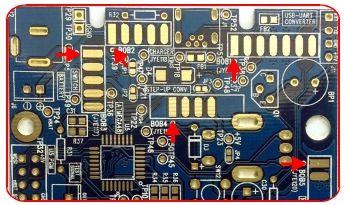
Note: Please install by the order given in the Part List below.

Part List

Catagory	Seq.	Type/Spec	Qty	Designator/Location
Main PCB	1	101-06802	1	
Resistor	2	510KΩ, 5%, 1/8W	2	R1, R27
	3	200KΩ, 1%, 1/8W	1	R3
	4	2MΩ, 1%, 1/8W	2	R2, R4
	5	20KΩ, 1%, 1/8W	1	R5
	6	300Ω, 1%, 1/8W	2	R6, R23
	7	180Ω, 1%, 1/8W	1	R7
	8	120Ω, 1%, 1/8W	2	R8, R12
	9	3.3KΩ, 1%, 1/8W	2	R10, R22
	10	470Ω, 1%, 1/8W	3	R11, R31, R33
	11	0Ω, 5%, 1/8W	1	R13
	12	10KΩ, 1%, 1/8W	4	R9, R21, R20,R30
	13	1KΩ, 5%, 1/8W	5	R24,R25,R26,R28,R29
	14	10MΩ, 5%, 1/8W	1	R40
Diode	15	1N4148, DO-35	2	D2,D3
Inductor	16	100uH, Φ2.5 X 6mm	3	L1,L4,L5
Crystal	17	20MHz, HCM-49	1	Y1
Connector	18	USB socket, MiNi-B type	1	J1
Switch	19	Tact, 6 X 6 X 5mm	1	SW12
Capacitor	20	300pF, ceramic disk	2	C2,C23
	21	3pF, ceramic disk	1	C4
	22	1pF, ceramic disk	1	C6
	23	120pF, ceramic disk	2	C7, C13
	24	0.1uF, ceramic disk	12	C9,C10,C11,C12,C14, C15,C16,C18,C20,C24, C25,C26
	25	15pF, ceramic disk	2	C21,C22
	26	0.1uF/100V, CBB	1	C1
Buzzer	27	5V, passive, Φ9 X 5.5mm	1	BP1
Diode	28	LED, Φ3mm, red	1	D1
Connector	29	2pins, 2.54mm	2	J6, J10
Transistor	30	8550, TO-92 (E-B-C)	2	Q1, Q2
Electro. Capacitor	31	10uF,16V, Φ4 X 5mm	1	C19
	32	100uF,16V, Φ6X 7mm	5	C17,C27,C28,C29,C30
Connector	33	DC005, Φ2.1mm core	1	J2
BOB Board	34	JYE116, step-up convertor	1	BOB4
	35	JYE120, neg. P.S. convertor	1	BOB5
	36	JYE117, On/Off switch	1	BOB3 (optional)
	37	JYE118, battery charger	1	BOB2 (optional)
	38	JYE119,UART-USB conv.	1	BOB1 (optional)
Now perform power-up test. See steps at the reverse page. Continue following assembly after test.				
Switch	39	Slide switch, SS-23D06	3	SW1,SW2,SW3
Switch	40	Rotary Enc., EC11, 10mm	1	SW4
Pin Strip	41	SIP, 2mm, 20X1	1	ASSY1
	42	SIP, 2mm, 2X1	2	ASSY2,ASSY3
LCD	43	128X64 graphic, 12864-16	1	LCD1
Pin strip	44	DIP, 2.54mm, 5X2	2	J4,J5 (Do not install)
Enclosure	45	Top(1), bottom(1), stand(1) switch caps(3), dial cap(1)	1 set	
Switch	46	7-key silicone button pad	1	
Connector	47	BNC, BNC-KY	2	
Wire	48	2-core hood-up wire, 10cm	1	
Screw	49	2.3*8mm, self tapping	4	
Acrylic	50	Tool for holding BOB	1	

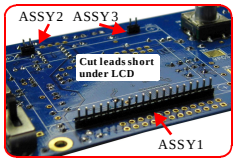
BOB Boards Installation

Pin 1 location indicated by arrow (square pad)

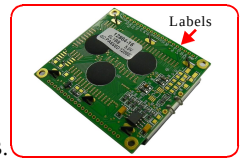


LCD Installation

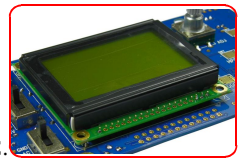
Important! Unused leads under LCD must be cut flush to avoid short to LCD module!



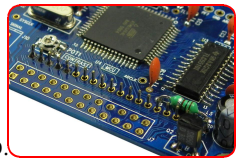
A. Lay PCB flat. Insert mounting strips with longer pins into holes.



B. Identify the holes with labels on LCD. They should go with the long strip.



C. Put LCD onto strips as shown. Solder pins at corners first. Do the rest after flatness ensured.



D. Turn LCD and main boar over. Complete soldering following same procedures as in C.

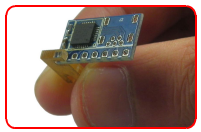
BOB Board Installation

BOBs and Jumpers

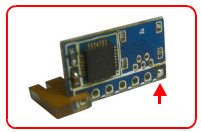
Keep JP1 open if BOB2 is installed. Otherwise short it.

Keep JP2 open if BOB3 is installed. Otherwise short it.

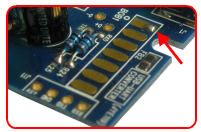
More at the reverse page



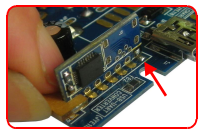
A. Use the small acrylic tool provided.



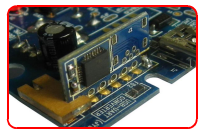
B. Apply solder to one pin.



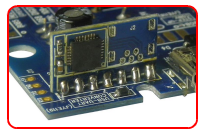
C. Apply solder to the corresponding pin on main PCB.



D. Put BOB to place and align pads.



E. Maintain BOB upright and fix it by melting the solder.



F. Finish the rest pins.

Step 2 Power Up the First Time

Powering-up Test

- ▶ Double check to ensure no missed, cold solder or shorts
- ▶ Make sure BOB4 and BOB5 have been installed
- ▶ Close JP2 for the time being (even BOB3 is in place)
- ▶ Keep JP3、JP4 open

USB powered / Battery powered

Close JP1 if no BOB2

▶ Keep JP1 open
▶ Make sure BOB2 in

Power up. Check voltage at +5V test point. Is it +5V? — No → Follow "No Power" flow chart to check

Yes

Power off. Close JP4 (★) You can continue to install front side parts if reached here

Power up and check +5V again. Is it still +5V? — No → Check for soldering mistakes. Wrong polarity, shorts, etc.

Yes

Press SW12. Do you see LED blink once (if bootloader installed) and then twice ? — No → ▶ LED reversed ? ▶ U4 pin 20 voltage low ? ▶ Check Y1、C21、C22

Yes (★)

LCD backlight on ? — No → Follow "LCD Dark" flowchart to check

Yes

Adjust contrast. Can you see display? — No → Follow "No display" flowchart to check

Yes

Press buttons. Do you see reaction on screen ? — No → Check U5 and soldering of button related pins

Yes

Set cursor to timebase. Turn [ADJ] dial. Do you see timebase change ? — No → Check U5 and soldering of rotary encoder pins

Yes

Now the digital part is working

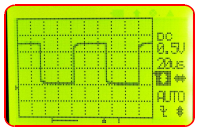
TIP: If JP7 is closed you will here beeps while LED blinks

Check Analog Part

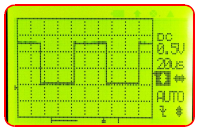
- Is AV+ normal (+5V) ? — No → Check L4, C29, C9, and C10
- Yes → Is V- normal (-5V) ? — No → Check BOB5 and C27
- Yes → Is AV- normal (-5V) ? — No → Check L1, C28, C11, and C12
- Yes → Is VA normal (+5V) ? — No → Check L5, C16, and C17
- Yes → Set SW1, SW2, SW3 to GND, 10mV, and X1 respectively
- Is V2 measured 0V? — No → Check SW1, SW2, and R1
- Yes → Is V3 measured 0V? — No → U1 may have been damaged
- Yes → is V4 measured ~1.6V? — No → Check SW3, R9, R10, R11
- Yes → Adjust VPOS. Can you see trace displayed ? — No → Follow "No Trace" flowchart to check
- Yes → Scope is working now

Powered by USB: V+ ≈VBUS - 0.7V
Powered by Batt.: V+ ≈ VBAT

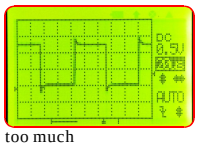
Step 3 Adjust Compensation Capacitors



Not enough



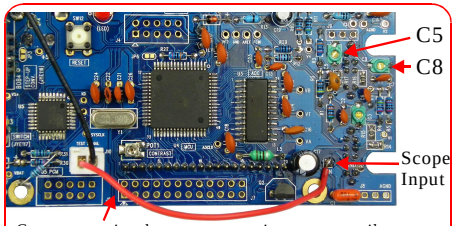
Good



too much

Compensation capacitors can be adjusted using the built-in signal generator. Follow steps below:

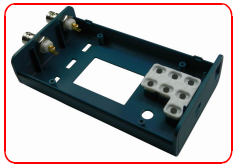
1. Connect test signal output to scope input (see photo below) and set SW1 to DC.
2. Power up. Set test signal to 10KHz and 5V. Set scope timebase to 20us.
3. Set SW & SW3 to 1V & X2 respectively. Adjust trigger level to make display stable if necessary. Change C8 to obtain waveform as the middle of photos left.
4. Keep signal frequence unchanged and set amplitude to 1V. Set SW2 & SW3 to 0.1V and X5 respectively. Make display stable. Change C5 to obtain waveform as the middle of photos left.
5. Remove connection between test signal output and scope input. Adjustment is done.

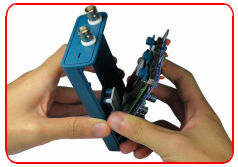


Connect test signal output to scope input temporarily

Step 4 Install Batter & Enclosure

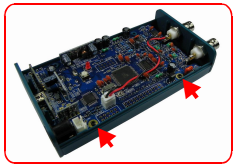
Tech Support: www.jyetech.com/forum

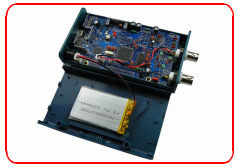

A. Install BNC connectors and place silicone pad.


B. Cap slide switches. Insert board to connector holes.


C. Hold board tight towards USB end and push in.

D. Connect BNC connectors to main board as shown.


E. Tight two screws as indicated by arrows.


F. Attach batt. to back cover. Avoid high parts (J10, C30).


G. Put on back cover. Tight the two screws as shown.


H. Put dial cap on and you are done.

Check Mode and Its Usage

What is "Check Mode"

Check Mode is to assist connection checking for most MCU pins. Once in Check Mode MCUs will generate high and low levels at those pins. These levels can be easily checked with a volt meter and consequently find out pin connections. This is particularly useful for checking out suspecious SMD solderings.

How to Enter "Check Mode"

Close JP6 and power up the system. It will anter "Check Mode". You should see LED flashes at about 3 second cycle.

Remember restore JP6 to open after checking.

Use of "Check Mode"

We want to check the connection between U3 pin12 and U4 pin17, for example. First enter Check Mode as stated earlier. Measure voltage at U3 pin12 with a volt meter. If voltage change between 0V and 5V is observed the connection is good. Otherwise is bad.

"Check Mode" Related Pins

Not all pins have the Check Mode function. The pins that do are listed as following:

U4: PB[7:5, 3:0], PC[7:0], PD[7, 5, 3, 1, 0], PE[7:3], PF[7:0], PG[4:0]

U5: PB[5:1], PC[3:0], PD[7, 6, 4:1]

Major Jumpers Explained

JP1: This by-pass of charger BOB2. If battery is not used (as result, no BOB2) keep JP1 closed.

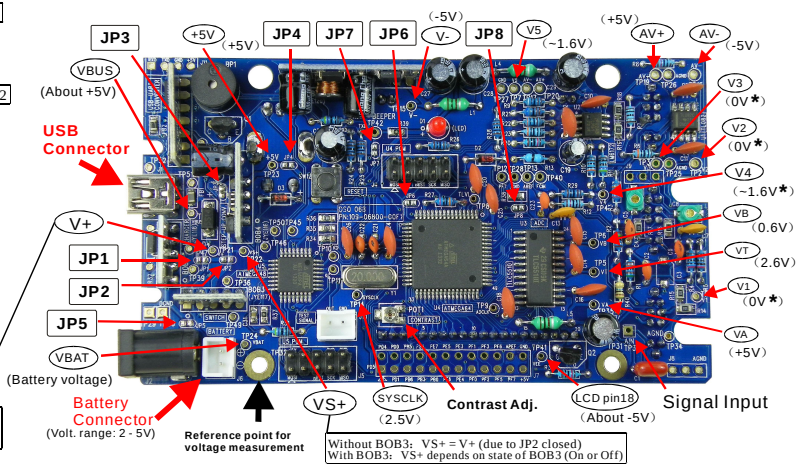
JP2: This is by-pass of switch BOB3. If BOBs is not used JP2 should be closed. In order to focus on the main circuit we temporarily close JP2 at power-up test even BOBs is installed. It is kept open after test.

JP3: This is by-pass of step-up converter BOB4. Usually JP3 is kept open.

JP4: This is the connecting point of power supply and the rest circuits. For the safety of the rest circuit only close JP4 after power supply is tested good.

Troubleshooting

Notes:
1. All voltages are measured with volt meter's (-) pole at reference point (indicated in photo below) and (+) pole at points of measurement.
2. Voltages with " ★ " are measured when SW1 (couple) is placed at GND position.



No Power

USB powered / Battery powered

- Check USB ← No ← Is VBUS measured ok? — Yes → Check D4 ← No ← Is V+ measured ok ? — Yes → Is VS+ measured ok ? — No → BOB3 installed ? — No → Check JP2; Yes → BOB3 installed ? — Yes → Check BOB3; Yes → Is VS+ measured ok ? — Yes → Is +5V measured ok ? — No → Check BOB4; Yes → Power good
- Battery voltage ok ? — No → Check batt. — Yes → Is V+ measured ok ? — No → Check BOB2 — Yes → (to Is VS+ measured ok ?)

LCD Dark

- Is voltage at LCD pin 19 5V? — No → Check related connections — Yes → Short C and E of Q2. Does LCD light up? — No → Possible LCD issue — Yes → Check Q2, R30 and connection with U5

No Trace

- Ensure all analog voltages are normal (see photo)
- VT and VB normal? — No → U3 damaged
- Yes → Connection between U4 pin17 and U3 pin12 good ? — No → Check out the cause — Yes → U3 has bad soldering or has been damaged

No Display

- Press SW12. Does LED blink as it should be ? — No → ▶ Check Y1, C21, C22 ▶ Volt at U4 pin20 too low ? ▶ Re-program U4
- Yes → Is contrast changeable by POT1? — No → Volt. at LCD pin18 negative? — No → (to Check all connections between U4 and LCD for opens or shorts.); Yes → Check POT1 and related
- Yes → Check all connections between U4 and LCD for opens or shorts.
- U4 and LCD connection good ? — No → Eliminate bad connections
- Yes → LCD defective